

THREE NEW RAINFROGS OF THE *ELEUTHERODACTYLUS DIASTEMA* GROUP FROM COLOMBIA AND PANAMA

por

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Resumen

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De las diez especies conocidas del grupo de *Eleutherodactylus diastema* distribuido desde Nicaragua hasta Ecuador, se han encontrado seis especies en el occidente de Colombia. Dos especies pertenecen a un subgrupo plesiomórfico mientras que las otras ocho especies pertenecen al subgrupo *diastema* (incluyendo las tres especies descritas como nuevas). Existen hasta cuatro especies simpátricas en las tierras bajas del norte del Chocó (todas distinguibles por tamaño corporal).

Palabras claves: Especies nuevas, Grupo de especies de *Eleutherodactylus diastema*, Ranas de los "tinks", Sistemática, Taxonomía.

Abstract

Frogs of the *Eleutherodactylus diastema* group are found in the lowlands of western Colombia and are represented by six species. Ten species are recognized in this species group distributed from Nicaragua to Ecuador. Two of the species (*E. chalceus* and *E. scolodiscus*) are placed in a plesiomorphic subgroup whereas the other eight species of the group are placed in the *diastema* subgroup (including three species described as new, two from the northern part of the biogeographic Chocó and one from the eastern slopes of the Cordillera Central). As many as four species are found sympatrically in the northern lowlands of the Chocó (all separated neatly by differences in body size).

Key words: *Eleutherodactylus diastema* species group, New species, Systematics, Taxonomy, Tink frogs.

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Introduction

Lynch & Duellman (1997) included six species in the *Eleutherodactylus diastema* group and **Savage** (1997) named a seventh species. **Savage** (1997) suggested that two subgroups be recognized: one for the taxa having lanceolate or papillate disk covers (*E. chalceus*, *E. gularis*, *E. scolodiscus*, and *E. vocator*) and the second for species with palmate or spatulate disk covers (*E. diastema*, *E. hylaeformis*, and *E. tigrillo*). Shortly after I illustrated papillate disk covers (**Lynch**, 1976), I began to suspect that I was confusing some species in western Colombia; resolution of my suspicions required 20 years. Work on the Colombian fauna during the past few years resulted in sorting out my earlier confusion but necessitates descriptions of some additional taxa and a review of the features of the digital disks and covers. Critical to the sorting out of these small frogs was the opportunity to hear three species calling sympatrically in western Departamento de Valle del Cauca in July 1997.

At present, *E. chalceus* and *E. gularis* are known from the Pacific lowlands of Colombia and Ecuador (**Lynch & Duellman**, 1997), *E. diastema* is known from Nicaragua to western Panama (**Savage**, 1997), *E. hylaeformis* and *E. tigrillo* are known from the Talamancan Range in Costa Rica, and probably western Panama (**Savage**, 1997), *E. scolodiscus* is known from moderate elevations on the western slopes of the Andes in southern Colombia and northern Ecuador (**Lynch & Duellman**, 1997), and *E. vocator* is reported from Costa Rica to western Colombia (**Savage**, 1997). Under the present proposal, six species of the group are found in western Colombia with as many as four species sympatric. Two species, both described herein, are endemic to Colombia.

These frogs have short, broad fingers and toes, a short first finger, a very long fifth toe, a head distinct from the body, granular venter, long vocal slits, and lack nuptial pads. In most, the digital disks are pointed at the distal end, reflected as well in triangular disk pads. In most species, the deflated vocal sac of males shows a pair of) (- shaped folds. This last character (Fig. 1) has long been cited as a characteristic of the group (**Dunn**, 1926, **Cochran & Goin**, 1970, **Savage**, 1997), but is not present in *E. chalceus* or in *E. scolodiscus*. These same two species have bifid palmar tubercles rather than the entire, oval palmar tubercles seen in other species of the *E. diastema* group.

My view of these small frogs differs from that of **Savage**. I view two as forming one subgroup (*E. chalceus* and *E. scolodiscus*) whereas the remaining species I assign

to another subgroup (including the three species named herein). On the presumption that oval palmar tubercles and the) (- shaped vocal sacs represent derived states, one may define a subgroup for all but two species of the *E. diastema* group. This, of course, means that "papillate disk covers" must represent a convergence within this cluster of frog species (*contra* **Savage**, 1997). Furthermore, I do not consider the type-specimens of *E. vocator* to be conspecific with a frog found from the Canal Zone to the Buenaventura region of Colombia.

Materials and Methods

Primarily, I have relied on collections in three institutions – ICN (Instituto de Ciencias Naturales), KU (University of Kansas Natural History Museum), and LACM (Los Angeles County Museum of Natural History but report some data from IAvH (Instituto Alexander von Humboldt, Villa de Leyva, Colombia, formerly IND-AN,INDERENA). Measurements were taken using a dial caliper and stereomicroscope (and are reported as means \pm 1 standard error of the mean). Sex was determined by gonadal examination. Abbreviations and descriptions follow **Lynch & Duellman** (1997).

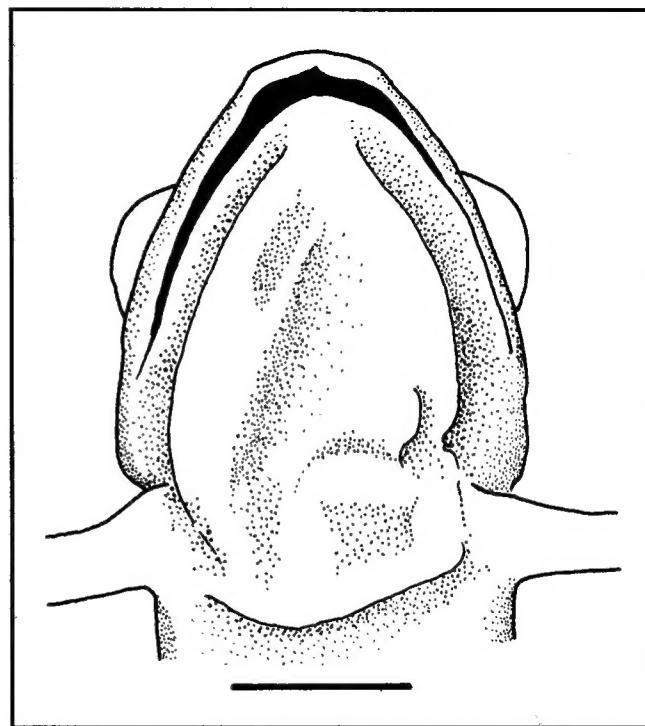


Figure 1. Ventral view of head of *Eleutherodactylus quidditus* (LACM 46903) illustrating longitudinal gular folds. Scale equals 2 mm.

CHARACTERS

Characters of the digital disks

Savage (1987) once termed pointed disk covers (and disk pads) as cuspidate but later (**Savage**, 1997) employed "spadate" and "lanceolate" as additional states. I concur with Savage's characterizations of the disk covers and pads of *E. diastema*, as often being "palmate" (= round distally) rather than "spadate" (= pointed distally) and the disk pads as seldom being triangular. Among the species of the *diastema* subgroup, one finds at least three states of the disk covers (= ungual flap of **Lynch**, 1979) – unornamented (Fig. 2A, 2D), bearing a knob (Fig. 2B), or bearing a papilla (Fig. 2C).

In *E. diastema*, in my experience (and that of **Savage**, 1997), the disk pads are usually round rather than triangular whereas this is not the case for at least some disk pads in other species. Once again, in my experience, the disk pads of fingers I and IV are usually rounded apically whereas obviously triangular disk pads occur on fingers II and III. I am reluctant to place much weight on this

character because of the variations in preservation techniques (I have seen many specimens of *E. gularis* preserved in such a way to give the impression of round disk pads, even specimens preserved by the same individual). In *E. gularis*, unornamented disk covers and knobbed disk covers occur in about equal frequency (perhaps reflecting preservational techniques). Obviously triangular disk pads (ignoring fingers I and IV and toe V) are normal in *E. quidditus*, *E. tinker*, and *E. vocator* (and presumably in the Middle American species *E. hylaeformis* and *E. tigrillo*).

Distinct papillae (as contrasted with pointed disk covers) are seen on some digits of *E. chalceus*, *E. quidditus*, and *E. tinker*. Such papillae occur on fingers II and III as well as toes II-IV in *E. quidditus* (Fig. 3) but only on fingers III and IV as well as toes III and IV in *E. chalceus* and *E. tinker* (Fig. 4). Earlier reports (**Savage**, 1997) that *E. vocator* has papillae are based on specimens of *E. quidditus*. In the type-series of *E. vocator*, there are no digital papillae although the tips of finger III and toes III and IV are pointed.

The disk of the thumb is not expanded in *E. quidditus*, *E. tinker*, or *E. vocator* whereas other species of the group (and subgroup) have slightly expanded thumb disks (Figs. 3-4). The feature is not a function of size because the thumb disk of *E. anthrax* is expanded (a species slightly smaller than *E. tinker*).

Palmar tubercles

The palmar tubercle is bifid in *E. chalceus* and *E. scolodiscus* but is oval (undivided) in *E. anthrax*, *E. diastema*, *E. gularis*, *E. hylaeformis*, *E. quidditus*, *E. tigrillo*, *E. tinker*, and *E. vocator*. Round (or oval) palmar tubercles are unusual in the genus *Eleutherodactylus*. In fact, among the more than 650 species of the genus, I know of this state elsewhere only in *E. citriogaster* (**Duellman & Pramuk**, 1999) and *E. zeuctotylus* (**Lynch & Hoogmoed**, 1977). Such palmar tubercles also occur in centrolenids and dendrobatids.

Gular folds in) (-shape in males

This character has the same distribution with the *E. diastema* group as do the palmar tubercle states (the primitive condition in *E. chalceus* and *E. scolodiscus*, and the derived condition in the other eight species). Such folds are also seen in several small species from Cuba and Hispaniola, which caused **Dunn** (1926) to posit a relationship between the Middle American and some Caribbean taxa.

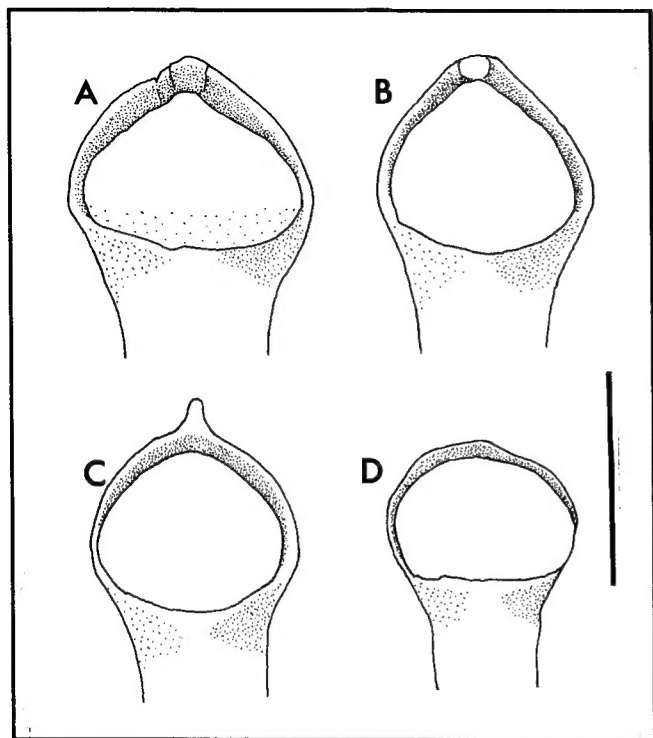


Figure 2. Ventral views of disk of third finger (left hand) of three species of the *E. diastema* species group. A. *E. gularis*, ICN 45168. B. *E. gularis*, ICN 45171. C. *E. tinker*, ICN 16723. D. *E. diastema*, KU 35149. Scale equals 1 mm.

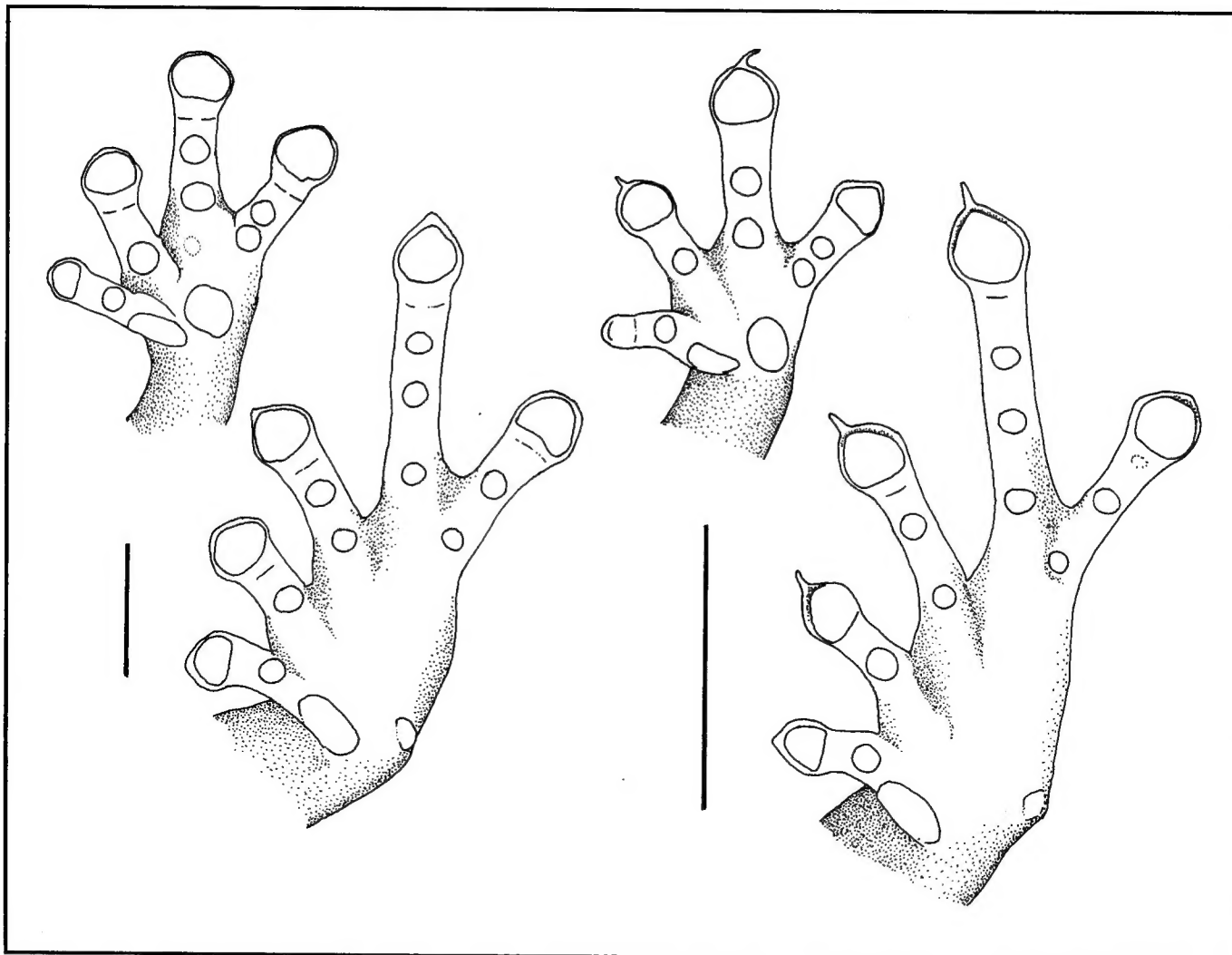


Figure 3. Hand and foot of *Eleutherodactylus gularis* (QCAZ 4316, left) and *Eleutherodactylus quidditus* (IAvH 5666, right). Scale equals 1 mm.

Testis (mesorchium) color

Because males of this group are usually so obviously males, I no longer recall why I began to open males to observe testis color (routine for me by 1984). However, the activity revealed differences between species. *Eleutherodactylus diastema* normally has black (or gray with brown reticulation) mesorchia whereas those of *E. chalcus*, *E. gularis*, *E. scolodiscus*, and *E. vocator* are white. The mesorchia of *E. anthrax*, *E. quidditus*, and *E. tinkler* are black (or gray with brown reticulum). Data are not available for *E. hylaeformis* or *E. tigrillo*. White mesorchia are surely primitive for *Eleutherodactylus* but pigmented mesorchia have evolved many times (e.g., *E.*

curtipes, *E. mexicanus*, and *E. prolixodiscus* on the mainland, *E. apostates*, *E. jugans*, *E. oxyrynchus*, *E. ventrilineatus*, and species of the *bakeri* series in the West Indies, Hedges, 1989). In the case of *E. diastema*, I examined 49 males (nine from Nicaragua and 40 from Costa Rica and found three with white mesorchia, KU 35141, 93893, 101991).

Sizes and proportions of adults

In the *E. diastema* subgroup, *E. hylaeformis* is the largest species (Savage, 1997, reports that males are 19-22 mm and females are 20-26 mm SVL). I suspect that he includes immature females in these ranges. Among the species found in Colombia, *E. gularis* is largest (Table 1),

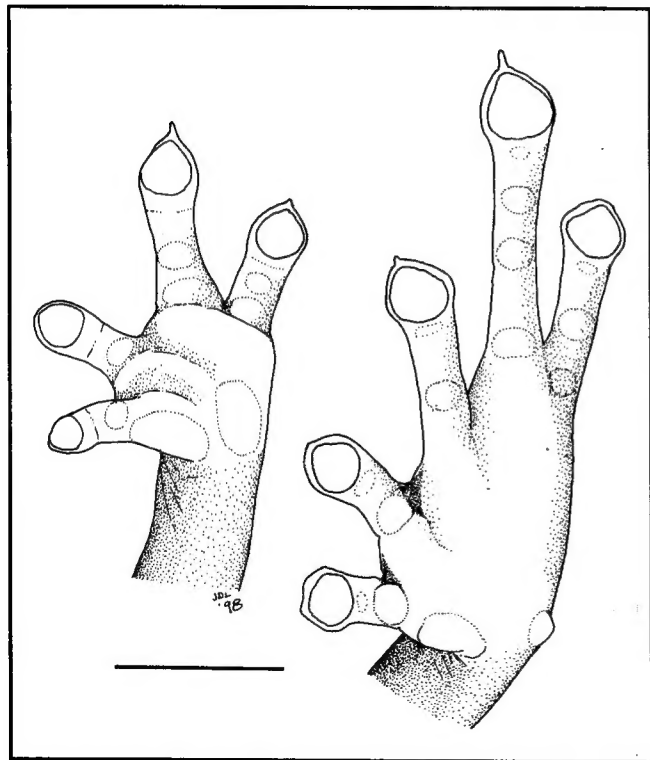


Figure 4. Hand (ICN 45176) and foot (ICN 45181) of *Eleutherodactylus tinker*. Scale equals 1 mm.

and *E. quidditus* the smallest with *E. tinker* and *E. anthrax* intermediate in size. Among the three species represented by abundant material, the female of the smaller is the size of the male of the next largest.

Savage (1997) commented on geographic variation in body size in *E. diastema* and the data at my disposal are consistent with his suggestion that *E. diastema* from the Talamanca Range is larger than the frogs from the lowlands. In 30 males from Nicaragua and Atlantic Costa Rica, body sizes of calling males are 15.2-19.9 ($\bar{x} = 16.9 \pm 0.2$) mm SVL whereas 30 males from the Talamanca Range of Costa Rica are 15.3-21.6 ($\bar{x} = 18.6 \pm 0.3$) mm SVL. A smaller sample of males from Pacific Costa Rica is even larger (16.9-21.7, $\bar{x} = 19.3 \pm 0.6$, mm SVL, $N = 8$). My samples of adult females are more limited: Nicaragua and Atlantic Costa Rica, $N = 5$, 17.1-22.5 ($\bar{x} = 20.6$) mm SVL; Talamanca Range, $N = 15$, 19.1-24.4 ($\bar{x} = 21.9 \pm 0.4$) mm SVL; 2 females from Pacific Costa Rica, 21.1-22.1 mm SVL.

Some differences are apparent in proportions (Table 1). These are all short-legged frogs but *E. quidditus* has longer hindlimbs than do other species. The Colombian and

Panamanian samples of *E. quidditus* differ in snout length (expressed as E-N/eye). Lastly, *E. anthrax* and *E. tinker* are peculiar in that males have larger tympani than do females (opposite the trend in other species of the group).

Skin texture (dorsum)

Eleutherodactylus tigrillo is peculiar within the group in having tubercles scattered over the dorsal surfaces (**Savage**, 1997). The skin texture of *E. chalcone* is granular (**Lynch**, 1971) and that of *E. quidditus* is best described as warty. The remaining species have nearly smooth skin of the dorsum.

Prominence of tympanum

These small frogs with thin skins easily desiccate, making the tympanum sometimes very prominent. In *E. chalcone*, *E. gularis*, and *E. scolodiscus*, the skin distal to the tympanic annulus is not modified (although the annulus can usually be seen through the skin). In *E. anthrax*, *E. quidditus*, and *E. tinker*, the tympanum is a prominent structure.

Vomerine odontophores

Savage (1997) reported that *E. hylaeformis* lacks vomerine odontophores and that *E. tigrillo* has few vomerine teeth. *Eleutherodactylus anthrax* lacks vomerine odontophores but has a few vomerine teeth. In contrast, vomerine odontophores and vomerine teeth are prominent in the other species of the *diastema* subgroup but are feebly developed in *E. chalcone* and *E. scolodiscus*.

Calls

The call of *E. diastema* ("tink" "tink") is well known to all alumni of the courses of the Organization for Tropical Studies. The calls of *E. tigrillo* and *E. tinker* are apparently the same. In contrast to these, the call of *E. gularis* is a whistle. The call of *E. quidditus* is an insect-like buzz. It was the data of calls (July 1997) that finally convinced me that the morphological differences that I had observed corresponded with species differences in this group.

Accounts of species

Eleutherodactylus chalcone (Peters)

This species, which **Lynch & Duellman** (1997) characterized as a lowland species, in spite of records to 2000 m, is known from western Colombia (from western Antioquia to the north) and Ecuador (**Lynch**, 1980). It is the largest species of the *E. diastema* group.

Eleutherodactylus gularis (Boulenger)

Excepting **Lynch** (1998) and **Lynch & Duellman** (1997), most previous accounts of this species have confused one or two additional species with *E. gularis*. **Cochran & Goin** (1970) reported *E. diastema* from western Colombia, based on specimens of *E. gularis*.

The account provided by **Lynch & Duellman** (1997) needs to be augmented only slightly although they underestimated the distribution of this species. Many more specimens are now available providing a more secure estimate of distribution, sizes, and proportions (Table 1).

Lynch & Duellman (1997) reported *E. gularis* from western Colombia (as far north as Pizarro, Chocó) and western Ecuador and implied that the species is found usually below 400 m. *Eleutherodactylus gularis* is distributed virtually the length of the biogeographic Chocó in Colombia and Ecuador but is found also across the northern bases of the cordilleras Central and Occidental. It ranges altitudinally from sea level to 1600 m. That most records are from elevations below 500 m may well reflect preferences of collectors.

Based on my fieldwork with this species in 1983 and 1997, it is easier to locate than *E. quidditus* or *E. tinker*, often found calling on the upper surfaces of leaves in primary and secondary forests (but occasionally from the undersides of leaves).

Eleutherodactylus scolodiscus Lynch & Burrowes

The summary account given by **Lynch & Duellman** (1997) remains accurate. The species is found in cloud forests of southern Colombia (Nariño) and northern Ecuador. It is easily recognized because of its blue iris.

Descriptions of new species

In the following accounts, some features are not provided in either the diagnoses or the descriptions because these features do not vary among species of the *E. diastema* subgroup. For the diagnoses, the following numbered elements do not exhibit variation: (1) skin of venter areolate or granular; no dorsolateral folds; (4) upper eyelid broader than IOD, no cranial crests; (6) males with large subgular vocal sac, no nuptial pads; (7) first finger shorter than second; (9) no ulnar tubercles; (10) no tubercles or folds on heel or tarsus; (11) no supernumerary plantar tubercles; (12) fifth toe much longer than third. For the descriptions, I have deleted these points as well as "palmar tubercle oval, larger than oval thenar tubercle; no supernumerary palmar tubercles".

Eleutherodactylus anthrax sp. nov.

Holotype. ICN 41696, adult male obtained on 20 March 1994 by J. V. Rueda (field number PR 15686).

Type-locality. COLOMBIA, Departamento de Caldas, Municipio Norcasia (formerly part of Samaná), at campamento La Miel II, near junction of quebrada Tasajos with Río La Miel, Km 23 carretera La Victoria – Samaná, 700 m,

Paratype. ICN 41697, adult female from el bosque de San Rafael, municipio San Rafael, Antioquia, 1200 m, obtained 9 September 1998 by M. Osorno.

Diagnosis. (1) Skin of dorsum smooth with low flat tubercles; (2) tympanum round, prominent, 31-38% eye length; (3) snout subacuminate in dorsal view, rounded in lateral view, short; (4) upper eyelid bearing small tubercle; (5) vomerine odontophores absent; (7) all fingers with expanded disks, that of finger III spatulate; (8) fingers lacking lateral fringes; (11) two metatarsal tubercles, inner oval, about 6 times size of outer; (12) toes bearing expanded disks, pads triangular on toes III-IV, no terminal papillae; proximal half of fifth toe fused to fourth; (13) dorsum brown with darker blotches, venter dark brown with whitish flecks; pale patches (red in life) on rear of upper arm, anterior and posterior surfaces of thighs, underside of shanks; (14) adults minute, one male 16.5 mm, one female 18.7 mm SVL.

Eleutherodactylus anthrax is most readily distinguishes from other species of the group by its coloration (dark venter with white flecks, pale blotches (red in life) on the concealed surfaces of the limbs. The distally rounded disk pads and disk covers (except for finger III and toes III-IV) coupled with some spatulate disk covers is also seen in the larger *E. diastema*.

Etymology. Greek, meaning a carbuncle (in its obsolete usage), a red precious stone. Name used as a noun in apposition and in reference to the red patches on the concealed surfaces of the limbs.

Description (See Table 1 for proportions). Head as broad as body, broader than long; snout subacuminate in dorsal view, rounded in lateral profile, short; canthus rostralis not defined; loreal region flat, sloping abruptly to lips; lips not flared; upper eyelid bearing low tubercle near lateral edge; anteroventral ½ of tympanum distinct, oriented vertically, separated from eye by distance equal less than tympanum length; supratympanic fold obscures posterodorsal half of tympanum; postictal tubercles low; choanae round, well lateral on palate, partially overlapped by palatal shelf of maxillary arch; no vomerine odontophores, 1-2 teeth median and posterior to choanae;

Table 1. Size and proportions of adults of four species of the *Eleutherodactylus diastema* subgroup. First line reports range of values (and N in parentheses). The second line reports the mean \pm 1 standard error of the mean.

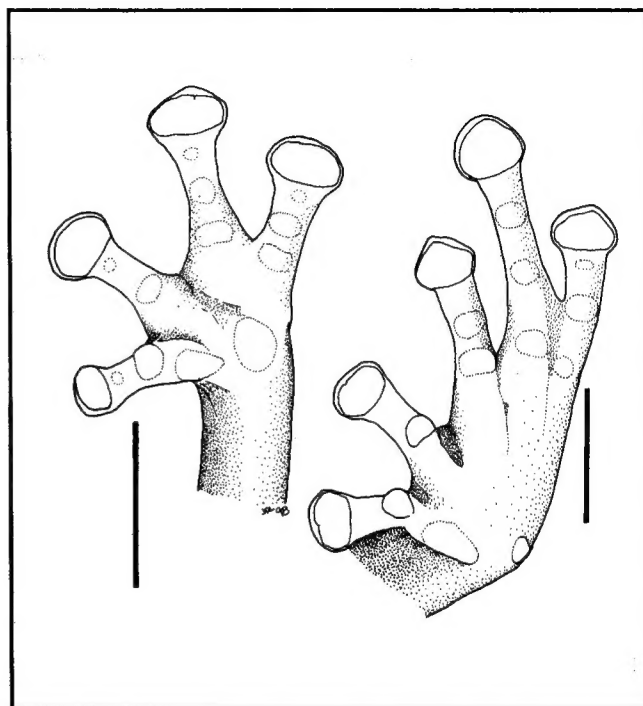
| Species/sex/ country | SVL | Tibia/SVL | HW/SVL | Eyelid/IOD | Tympan./eye | E-N/eye |
|---|----------------|----------------|----------------|-----------------|----------------|-----------------|
| <i>E. anthrax</i> male | 16.5 | 41.2 | 36.7 | 71.4 | 37.5 | 62.5 |
| <i>E. anthrax</i> female | 18.7 | 41.2 | 36.9 | 58.3 | 31.5 | 63.0 |
| <i>E. gularis</i> males | 17.2-22.4 (53) | 38.2-47.0 (53) | 34.0-41.1 (52) | 48.2-80.0 (43) | 17.9-42.3 (47) | 65.5-100.0 (50) |
| | 20.5 \pm 0.2 | 41.6 \pm 0.3 | 37.4 \pm 0.2 | 63.3 \pm 1.1 | 31.8 \pm 0.6 | 78.7 \pm 1.0 |
| <i>E. gularis</i> females | 21.2-25.4 (23) | 38.4-46.2 (23) | 34.4-39.5 (23) | 51.7-84.6 (22) | 25.9-41.9 (22) | 64.7-100.0 (23) |
| | 23.2 \pm 0.2 | 41.5 \pm 0.4 | 37.3 \pm 0.3 | 68.7 \pm 2.2 | 34.0 \pm 0.9 | 80.7 \pm 1.8 |
| <i>E. quidditus</i> Males Colombia | 11.1-14.8 (10) | 38.0-48.3 (10) | 34.3-38.5 (10) | 50.0-85.7 (7) | 31.2-50.0 (9) | 50.0-75.0 (9) |
| | 13.3 \pm 0.4 | 44.8 \pm 0.9 | 35.8 \pm 0.5 | 63.0 | 40.0 \pm 2.2 | 62.2 \pm 2.7 |
| <i>E. quidditus</i> Females Colombia | 13.5-16.9 (40) | 42.4-48.9 (40) | 31.0-37.7 (38) | 50.0-88.2 (37) | 27.3-55.6 (40) | 47.6-76.2 (40) |
| | 15.2 \pm 0.1 | 45.0 \pm 0.3 | 35.1 \pm 0.2 | 62.4 \pm 1.5 | 44.5 \pm 1.0 | 60.6 \pm 1.2 |
| <i>E. quidditus</i> males, Panama | 10.9-13.5 (12) | 41.4-50.5 (11) | 34.4-39.4 (11) | 50.0-71.9 (11) | 31.2-47.2 (11) | 58.8-72.2 (11) |
| | 12.6 \pm 0.2 | 45.4 \pm 0.7 | 36.5 \pm 0.5 | 63.6 \pm 2.3 | 39.7 \pm 1.8 | 65.8 \pm 1.2 |
| <i>E. quidditus</i> females, Panama | 13.2-16.4 (15) | 42.1-45.9 (13) | 35.4-37.9 (13) | 55.6-83.3 (13) | 34.1-50.0 (13) | 59.1-76.2 (13) |
| | 14.6 \pm 0.2 | 43.6 \pm 0.3 | 36.6 \pm 0.2 | 67.4 \pm 2.0 | 41.0 \pm 1.4 | 66.6 \pm 1.4 |
| <i>E. tinkler</i> males | 15.2-20.3 (38) | 38.5-47.8 (36) | 32.7-39.8 (36) | 50.0-105.9 (34) | 23.8-45.4 (36) | 47.6-83.3 (36) |
| | 17.3 \pm 0.2 | 42.7 \pm 0.3 | 36.7 \pm 0.3 | 69.9 \pm 1.8 | 36.0 \pm 0.8 | 68.6 \pm 1.1 |
| <i>E. tinkler</i> females | 19.0-21.8 (15) | 38.2-44.7 (15) | 34.3-37.6 (15) | 57.7-85.7 (14) | 23.1-40.0 (14) | 62.1-88.0 (14) |
| | 20.2 \pm 0.2 | 41.6 \pm 0.5 | 36.2 \pm 0.3 | 70.5 \pm 2.1 | 33.3 \pm 1.2 | 75.1 \pm 2.0 |

tongue longer than wide, widest posteriorly, its posterior border not notched, posterior 4/5 not adherent to floor of mouth; long vocal slits posterolateral to tongue; vocal sac just extending onto chest.

Skin of dorsum smooth except for very low, flat warts on lower back, upper surfaces of shanks; anal opening at posterior edge of thighs; low areolations on flanks, venter, and undersides of thighs; discoidal folds not apparent; arm slender; subarticular tubercles low, broader than long; fingers short, lacking lateral keels; all digits bearing broad disks; disk cover of finger III pointed, those of other fingers round, none with knobs (Fig. 5); disk pads broadly oval except for finger III which is subtriangular.

Inner metatarsal tubercle twice as long as wide; outer metatarsal tubercle round, 1/6 size of inner; subarticular tubercles low, broader than long; toes lacking lateral keels; tip of toe IV pointed, others rounded apically; disk pads of toes III-IV triangular (Fig. 5); tip of toe V reaches to distal edge of distal subarticular tubercle of toe IV; hindlimbs short, heels not touching when flexed hindlimbs held perpendicular to sagittal plane.

Coloration in alcohol. Dorsum brown with nearly black dorsal blotches (Y-shaped mark on snout,

**Figure 5.** Hand (ICN 41696) and foot (ICN 41697) of *Eleutherodactylus anthrax*. Scale equals 1 mm.

interorbital bar, scapular and sacral blotches); short cream dorsolateral stripes in sacral region; limb bars dark brown, broader than interspaces on thighs and shanks; anal triangle diffuse; ventral surfaces nearly black with whitish flecks; pale patch on posterior surface of upper arm, larger pale spots on anterior face of thigh, posterior surfaces of thighs, and undersides of shanks.

Color in life. Dorsal surfaces black with short red lines on dorsum; spots on arm, anterior and posterior surfaces of thighs, underside of shank scarlet; ventral surfaces black with white flecks; iris brown.

Measurements of holotype in mm. SVL 16.5, shank 6.8, HW 6.05, head length 5.7, chord of head length 6.4, upper eyelid width 1.5, IOD 2.1, tympanum length 0.9, eye length 2.4, E-N 1.5.

Natural history and distribution. Only two specimens are known, captured more than four years apart in the remnants of lower montane forests along the eastern base of the Cordillera Central. The holotype was calling on top of a leaf 1.5-2 m above the forest floor along a forested stream in primary but thinned forest. The area is generally described as one of pastures with gallery forests along streams. The late Pedro Ruiz told me that many individuals were calling in March 1994 but was unable to describe the call. The paratype was found in dense secondary forest in September and is gravid. She was located about 3 meters above the forest floor. Curiously, each individual lacks its right hand, apparently lost escaping predation events. The species is known only from the lower edge of the cloud forests (700-1200 m) in eastern Antioquia and Caldas of Colombia.

***Eleutherodactylus quidditus* sp. nov.**

Holotype. ICN 45173, an adult male obtained 20 July 1997 by Taran Grant and Paul Gutiérrez (field number JDL 21042).

Type-locality. COLOMBIA, VALLE DEL CAUCA, municipio Buenaventura, Estación Forestal (de la Universidad de Tolima) "Bajo Calima", 50 m, 3° 59' N, 76° 57' W.

Paratypes. COLOMBIA, ANTIOQUIA: Vigia del Fuerte, Río Arquía, Finca Chiribiquí (LACM 46951-52), Finca Los Llanos (LACM 46947-48). CHOCÓ: Bahía Solano, Alto del Buey, N slope, 420-1070 m (LACM 73238, 73240), 5 km NE cabecera municipal, vía Cerro Macana, 100-200 m (ICN 38150-52). Bovaya, hills near left bank of Río Napipí below mouth of Río Merendó (LACM 46964-74), upper Río Napipí below mouth of Río Merendó (LACM 46958-60), Serranía de Baudó, ridges (inland) paralleling Río Yupe (LACM 46903). Condoto, Andagoya

(USNM 144780). Tadó, Qda. Bocharona (LACM 46987). Valle, via a Utria, 2 m (UVC 13182-83).

Diagnosis. (1) Low warts scattered over dorsum; (2) tympanum round; (3) snout subovoid in dorsal view, rounded or subtruncate in lateral profile; (4) upper eyelid bearing very low tubercle or not; (5) vomerine odontophores low; (7) fingers II-IV with expanded disks, fingers II-III with elongate papillae; (8) fingers bearing thick lateral fringes; (11) two metatarsal tubercles, inner oval, three times size of outer; (12) toes with expanded disks, II-IV with elongate papillae; fifth toe partially fused with fourth; (13) dorsum brown with darker brown spots, venter brown with cream flecks; concealed surfaces of hindlimb brown; (14) adults minute, males 10.9-14.8 mm, females 13.2-16.9 mm SVL, geographically variably.

Etymology. Some years ago, I encountered a delightful book by Quine (1987) with a curious title. An unabridged dictionary provided me a definition "A trifling nicety of subtle distinction, as in arguments." and the word was filed as a potential name for some small frog. This frog seemed especially apt, having been confused with *E.gularis* and *E. vocator* and being such a small beast. The name is Latinized and used as a noun in apposition.

Description (see Table 1 for proportions). Head narrower than body, longer than broad; snout subovoid in dorsal view, rounded or subtruncate in lateral profile; nostrils weakly protuberant, directed dorsolaterally; canthus rostralis ill-defined, concave; loreal region slightly concave, sloping abruptly to lips; lips not flared; upper eyelid bearing very low tubercle or none; tympanum round, only upper edge concealed by supratympanic fold, separated from eye by distance equal about ½ its length; postictal tubercles very low; choanae round, partially concealed by palatal shelf of maxillary arch; vomerine odontophores low, median and posterior to choanae, each larger than a choana, bearing slanted row of 3-4 teeth, broadly separated medially (by width of an odontophore); tongue longer than wide (broadest posteriorly), posterior border not notched, posterior 2/3 not adherent to floor of mouth; long vocal slits lateral to tongue.

Low warts scattered over dorsum (excluding head), upper flanks, and upper surfaces of limbs; throat smooth; no anal sheath or perianal tubercles; no discoidal folds; posteroventral surfaces of thighs areolate; subarticular tubercles low, round (basal of IV broader than long); thick lateral keels on fingers; disk and pad of thumb scarcely expanded, of others slightly expanded; disks and disk pads elongate and/or cuspidate (especially fingers II-IV); fingers II-III with elongate papillae extending from disk cover (Fig. 3).

Outer metatarsal tubercle round, almost subconical, about 1/3 size of oval inner; subarticular tubercles round, low (more distal tubercles less elevated than proximal ones); toes basally webbed, relatively narrow, with lanceolate disks and pads that are larger than those of fingers; long papillae on disk covers of toes II-IV; tip of toe V reaches to distal border of distal subarticular tubercle of toe IV, of III to distal border of penultimate subarticular tubercle of toe IV; hindlimbs short, heels not touching when flexed hindlimbs held perpendicular to sagittal plane.

Coloration in alcohol. Brown above with darker brown spots over dorsum, limb bars, canthal-supratympanic stripe, and bars on anterior flanks; venter brown with cream flecks; groin, anterior and posterior surfaces of thighs brown; white flecks sometimes present below eye; interorbital bar brown, sometimes with slightly paler snout.

Color in life. Ventral surfaces black with white flecks. Iris brown. Dorsum brown with some orange high-lites and a cream interorbital bar. Concealed surfaces of limbs brown.

Natural history and distribution. At the type-locality, *E. quidditus* was abundant (based on calls) but nearly defeated our efforts to secure a specimen. Males called from epiphytes on trees (2-4 meters above ground) and the holotype was located after an extended search calling on the underside of a leaf some 1.5 m above the ground. Vicente Rueda captured a small series in the leaf litter during the afternoon and most Colombian specimens known were secured by Philip Silverstone during his diurnal searches for dendrobatid frogs. **Toft** (1981) characterized the species as a leaf-litter frog, specializing on ants. The species is known from eastern Panama and northwestern Colombia at elevations between sea level



Figure 6. Paratype of *Eleutherodactylus anthrax* (ICN 41697); photograph by Mariela Osorno



Figure 7. *Eleutherodactylus gularis* (ICN 45162).



Figure 8. Holotype of *Eleutherodactylus quidditus* (ICN 45173).



Figure 9. Paratype of *Eleutherodactylus tinker* (ICN 45177).

and about 500 m. Although this is a minute frog wherever found, specimens from central and eastern Panama are smaller than those from western Colombia (Table 1).

***Eleutherodactylus tinkler* sp. nov.**

Holotype. ICN 45174, an adult male obtained by Taran Grant 20 July 1997 (field number JDL 21039).

Type-locality. COLOMBIA, VALLE DEL CAUCA, municipio Buenaventura, Estación Forestal (de la Universidad de Tolima) "Bajo Calima", 50 m, 3° 59' N, 76° 57' W.

Paratypes. COLOMBIA, ANTIOQUIA: Valdivia, 1400 m (KU 132734). CHOCÓ: Lloró, vereda Peñalosa, CEMA (ICN 16722-23). CÓRDOBA: Tierralta, Represa Urrá, 115 m, 08° 01' N, 76° 13' W (ICN 43456-59). VALLE DEL CAUCA: Bajo Baudó, Pizarro (UVC 12826). Buenaventura, Bahía Málaga (UVC 8811, 8874, 9275), Bajo Anchicayá, 300 m (KU 168082), Bajo Calima (ICN 45175-82, UVC 8812-13, 11503, 12301, 12303, 12305-07, 12316, 12320, 12400-01, 12408, 12416), Llano Bajo (UVC 7320), Río Cajambre, Chiquero campamento 1 (UVC 7133), Río Cajambre, campamento 4 (UVC 7283).

Diagnosis. (1) Skin of dorsum smooth except for flattened warts on upper flanks; (2) tympanum round, prominent, 23-45% eye length; (3) snout acuminate in dorsal view, nearly protruding in lateral profile; (4) upper eyelid lacking tubercles; (5) vomerine odontophores low; (7) fingers with expanded discs, papillae borne on digits III and IV; (8) fingers bearing fleshy lateral keels; (11) two metatarsal tubercles, inner oval, about three times size of outer; (12) papillae on digits III and IV; (13) dorsum brown with darker brown spots and often cream dorsolateral stripes; venter gray to dark brown with white blotches on abdomen; concealed surfaces of hindlimb brown with cream flecks; (14) adults minute, males 15.2-20.3 ($\bar{x} = 17.3 \pm 0.2$) mm, females 19.0-21.8 ($\bar{x} = 20.2 \pm 0.2$) mm SVL.

Etymology. English for one who makes a call of a "tink"; the name is used as a noun in apposition and reflects the verbal rendition of the call.

Description (see Table 1 for proportions). Head as broad as body, as long as wide; snout acuminate in dorsal view, almost protruding in lateral profile; nostrils weakly protuberant, directed laterally or dorsolaterally; canthus rostralis not defined; loreal region weakly concave, sloping abruptly to lips; lips not flared; upper eyelid lacking tubercles; lower $\frac{3}{4}$ of tympanum prominent, upper edge concealed by diffuse supratympanic fold, separated from eye by $\frac{1}{2}$ its length, round; postrictal tubercles insignificant; choanae oval, not concealed by palatal shelf

of maxillary arch; vomerine odontophores median and posterior to choanae, low, bearing nearly transverse row of 5-6 teeth; odontophores $1\frac{1}{2}$ - 2 times width of a choana, separated medially by distance slightly greater than choanal width; tongue longer than wide, its posterior border not notched, posterior $\frac{2}{5}$ not adherent to floor of mouth; vocal slits long, $\frac{1}{2}$ length of mouth; vocal sac extending onto zonal region of chest.

Skin of dorsum smooth aside from low flattened warts (most numerous on upper flanks), that of posteroventral surfaces of thighs granular; anal opening extending to above posterior level of thighs; no perianal warts; arm slender; subarticular tubercles low, broader than long; fingers short, with broad fleshy lateral keels; all fingers bearing narrow disks and ventral pads; disk of thumb round, others cuspidate; disk cover of finger III bearing elongate papilla, knobs on disk covers of fingers II and sometimes IV (Fig. 4).

Outer metatarsal tubercle round, $\frac{1}{3}$ to $\frac{2}{5}$ size of oval inner; toes basally webbed (fleshy fringes on toes encompassing basal subarticular tubercles); disks expanded with cuspidate pads, about same sizes as those of fingers; tip of toe V reaches to distal border of distal subarticular tubercle of toe IV, of III to distal border of penultimate subarticular tubercle of toe IV; subarticular tubercles low, broader than long; short papillae on disk covers of toes II-IV; hindlimbs short, heels not touching when flexed hindlegs held perpendicular to sagittal plane.

Coloration in alcohol. Dorsum reddish-brown with cream interorbital bar and often cream dorsolateral stripes; interorbital bar bordered posteriorly by dark brown to black bar; small dark brown spots on dorsum forming dorsal chevrons; side of head and flanks marked with dark brown (canthal stripe fused to labial bars); white flecks below eye, along lower lip and on lower flanks; limb bars broad, perpendicular on shanks; white bands across digit tips proximal to disks; throat, chest, and undersides of limbs dark brown to gray with white flecks; abdomen white with brown flecks or reticulum to brown with white flecks (appearing gray in contrast to darker throat and undersides of thighs); concealed surfaces of limbs brown with some cream flecks.

Color in life. Iris pale brown, flecked with gold, with black or brown reticulations, black or brown horizontal stripe. Frog is brown above with a tan interorbital bar and dorsolateral flank stripes. White flecks along lip. Vocal sac pale brown; venter dirty white with brown marbling (or dark brown with white flecks); concealed surfaces of limbs brown (but ICN 45176 had an orange patch on the

top of the thigh, continuing onto posterior surfaces of thighs).

Natural history and distribution. During fieldwork at Bajo Calima in July 1997, *E. tinker* was much less abundant than *E. gularis* (based on calls). Males called from concealed sites, often inside a dried leaf, requiring considerable effort to locate each individual. Males called in head-down, head-up, and horizontal positions. This species occurs to elevations of at least 1880 m and is distributed from southern Córdoba and western Antioquia south to Valle del Cauca.

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APPENDIX (SPECIMENS EXAMINED)

Only Colombia and Panamá

Eleutherodactylus gularis

COLOMBIA, NO DATA: UVC 6849, 11391. **ANTIOQUIA:** Dabeiba, Río Amparradó, 805 m (ICN 8664, 10621). Frontino, vereda venados, Parque Nacional Natural Las Orquídeas, Qda. La Miquera, 1030-1060 m (ICN 19304-06). San Carlos, bosque San Carlos, 1200 m (ICN 40798-99). Valdivia, corregimiento Puerto Valdivia, 675 m (ICN 38282). Vigía del Fuerte, Río Arquía, Puerto Palacios, 50 m (ICN 577, LACM 47077-79, 47081-83). **CAUCA:** El Tambo, Parque N. N. Munchique, El Tambito, 1600 m (ICN 45161). Guapí, Isla Gorgona (IAVH 4374-77, ICN 45159-60, USNM 145134, UVC 5658-66, 6929, 7789-90). Timbiquí, Qda. Saija (ICN 40268). **CHOCÓ:** Bahía Solano, El Valle, Boroboro Embará, 40 m (UVC 13139-40), upper Río del Valle, 50 m (LACM 73233). Bajo Baudó, Pizarro (USNM 147232, UVC 12851, 12853, 12877). Istmina, carretera Quibdó-Istmina, Qda. San Pablo (IAVH 5852). Quibdó, Río Atrato, Quibdó (LACM 47076). **NARIÑO:** Barbacoas, Km 44, carretera Altaquér-Tumaco, 650 m (ICN 36833-36). Tumaco, vicinity La Guayacana (LACM 50525). **VALLE DEL CAUCA:** Buenaventura, Agua Clara (UVC 11620), Bahía Málaga, Isla La Muerte (UVC 8816-20), Estación agroforestal "Bajo Calima", 50 m (ICN 45162-72, UVC 5657, 6807, 6809, 6930, 8814-15, 9693, 9729, 9866, 12302, 12314, 12321, 12399, 12402-05, 12407, 12410, 12414), campamento Agua Bonito, 300 m (ICN 13292), club de buceo de barracudas, Río Sabaletas, Km 10 (UVC 10706-07), Llano Bajo (UVC 6603), Río Cajambre, "Caimancito", 75 m (UVC 7187-88), Río Raposo biological station (LACM 50523, USNM 151396, 151400), San Cipriano (UVC 11656), Zaragoza, 300 m (UVC 11514).

Eleutherodactylus quidditus

COLOMBIA, **ANTIOQUIA:** Vigía del Fuerte, Río Arquía (LACM 47086), Finca Chiribiquí (LACM 46951-52), Finca Los Llanos (LACM 46947-48). **CHOCÓ:** Bahía Solano, Alto del Buey, N slope, 420-1070 m (LACM 73238, 73240), 5 km NE cabecera municipal, vía Cerro Macana, 100-200 m (ICN 38150-52). Bovaya, Río Merendó (LACM 46961), hills near left bank of Río Napipí below mouth of Río Merendó (LACM 46963-74), upper Río Napipí below mouth of Río Merendó (LACM 46958-60), trail between Río Napipí and upper Río Merendó (LACM 46975), upper Río Opopadó above mouth of Río Merendó (LACM 46976-77). Límite Bovaya-Riosucio,

camino de Yupe, 420 m (LACM 73234, 73236-37), Serranía de Baudó, ridges (inland) paralleling Río Yupe (LACM 46903, 46978-79, 46981-86, 47087-88). Condoto, Andagoya (USNM 144780). Istmina, Qda. Cubi (ICN 4954). Quibdó, upper Río Buey, near first cholo tambo (LACM 50527, 50529). Tadó, Qda. Bocharona (LACM 46987). Valle, vía a Utría, 2 m (UVC 13182-83). **VALLE DEL CAUCA:** Buenaventura, Estación agroforestal "Bajo Calima", 50 m (ICN 45173). Darién, campamento Vegas, 200 m (ICN 13275).

PANAMÁ .CANAL ZONE: Barro Colorado Island (KU 172410-11), Pipeline Road at Río Frijoles, 90 m (KU 172412-17). **COLÓN:** Río Guanche, 15 m (KU 172400-09), Santa Rita Ridge, 300 m (KU 172399). **PANAMÁ:** El Llano-Cart Road, Km. 9-10, 200 m (KU 172365-80), Km 11.7-12.5, 250 m (KU 172381-86), Km. 18, 275 m (KU 172387-90), Km. 22.6, 300 m (KU 172391-98). **SAN BLAS:** Camp Summit, 300 m (KU 114991-5006).

Eleutherodactylus tinkler

COLOMBIA, NO DATA: UVC 11392. **ANTIOQUIA:** Dabeiba, Río Amparradó, 805 m (ICN 10622, 34862). Frontino, vereda Callas, Parque Nacional Natural Las Orquídeas, Qda. Las Canoas, 1770-1820 m (ICN 19303), vereda Venados, Qda. La Miquera, 1030-1060 m (ICN 19144), Valdivia, 1400 m (KU 132734), Vigía del Fuerte, Puerto Arquía (LACM 47080), Río Arquía, 5 km W Finca Chiribiquí (LACM 46953-57), Finca Los Llanos (LACM 46946, 46949), near Puerto Palacios (LACM 46942-43, 47084-85). **CHOCÓ:** límite Bovaya-Riosucio, Serranía de Baudó, camino de Yupe, 420 m (LACM 73236), ridges (inland) paralleling Río Yupe (ICN 569, LACM 46980). Istmina, ICN 4953, carretera Quibdó-Istmina, Qda. San Pablo (IAVH 5854-56). Lloró, vereda Peñalosa, CEMA (ICN 16722-23). Quibdó, upper Río Buey, near first cholo tambo (LACM 50528). **CÓRDOBA:** Tierralta, Represa Urrá, 115 m, 08° 01' N, 76° 13' W (ICN 43456-59). **VALLE DEL CAUCA:** Bajo Baudó, Pizarro (UVC 12826). Buenaventura, Bahía Málaga (UVC 8801, 8811, 8874, 8909, 8937, 9275), Bajo Anchicayá, 300 m (KU 168082, UVC 5860), Bajo Calima (ICN 45174-82, UVC 8812-13, 11503, 12301, 12303, 12305-09, 12316, 12320, 12322, 12400-01, 12408, 12416), Llano Bajo (UVC 7320), Río Cajambre, Chiquero campamento 1 (UVC 7133), Río Cajambre, campamento 4 (UVC 7283). Darién, campamento Río Azul, 500 m (ICN 13277), campamento Vegas, 200 m (ICN 13276).